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New Developments in the Frozen Food Industry...

...A STUDY OF CAPITAL REQUIREMENTS

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HIGHLIGHTS

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The frozen food industry represents a $5\frac{1}{4}$ billion investment. The growth of capital requirements in the frozen food industry has been associated with the adoption of technological improvements and an increase in mass marketing. This growth is also associated with an increase in size of operations and in specialization.

The growth in mass marketing of frozen foods means that large volumes with uniform quality are needed throughout the year. To achieve uniform quality, additional capital investment is required. Frozen food processors have attempted to obtain uniform quality through product specifications and contractual arrangements with growers or through direct production of the commodities they are using. As production of frozen food expands, these efforts will be extended.

Similarly, the large retail buying units have attempted to insure themselves of supplies with uniform quality. If processors fail to meet these requirements, the large retail buying units may attempt to take over the control of quality themselves. They could do so either by more rigid buying specifications and contractual arrangements or by ownership of the facilities (integration) from retailing back through production. The trend toward contractual arrangements or integration may be attributed to the economic advantages which mass merchandising appears to offer the overall marketing system.

Mass marketing of frozen foods tends to increase both the scale of production and grower specialization. In turn, this increases the capital requirements of the growers. It may also affect the competitive position of different producing areas.

The long-term storage of frozen foods has shifted from terminal market and wholesale redistributing points to processing points. The causes of this shift are economic. It is associated with direct short-term purchasing by the large retail buying units. This has shifted more of the financing of inventories back to the frozen food processors. Mass distribution has also brought about a change in the type of storage facilities at retail distribution points.

Competition among frozen food packers for the limited zero-degree cabinet space in retail stores is keen. The limited display space is usually more of a restriction on the number of brands displayed than on the number of items offered. This competitive situation may encourage further mergers at the packing level as well as a number of other adjustments at the processing and wholesaling levels.

The ability to obtain capital and to use it efficiently may limit freedom of entry into the frozen food business in the future. It is becoming increasingly difficult for inefficient operations to gain a foothold. Increased specialization may enable small operators, particularly frozen food distributors, to compete successfully with the larger firms. The trend toward large-volume, low-margin distribution of frozen foods is becoming a restrictive factor on the introduction and promotion of new products.

NEW DEVELOPMENTS IN THE FROZEN FOOD INDUSTRY

A Study of Capital Requirements

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Frozen foods have been one of the most important developments in the food industry in recent years. Most of the growth in production of frozen foods has occurred since World War II. A whole new marketing structure had to be developed. The coordinated efforts of every segment of the trade were required. New varieties of fruits and vegetables were developed for freezing. New and improved methods of quick freezing were required. New packaging materials, specially designed for each type of frozen product, had to be developed. Below-zero storage, all the way from packer to consumer, required new refrigerating facilities at every step in the marketing process. Many of these changes are already evident, while others are still in process of development.

Each change requires increased investments of capital. The amount of capital investments is one way of measuring the change which has occurred. Also, the growth in capital requirements affects competition within the industry. Where capital requirements are high, freedom of entry may be greatly restricted.

This report is designed to show the magnitude of the changes in capital requirements for processing and distributing frozen foods, and to indicate further adjustments that may be necessary and how they may affect the competitive structure of the industry. This research project is part of a continuing program designed to increase the efficiency of the marketing processes for farm products.

A comparison of the growth in production of frozen foods with that of the facilities needed to handle them illustrates how frozen foods have added to the demand for capital. Comparisons at each marketing level show the growth of capital invested in (1) warehousing facilities in which temperature is maintained at zero degrees, (2) low-temperature transportation facilities, (3) low-temperature display cases in retail stores, (4) locker plants, (5) home freezers, (6) distribution, and (7) processing. Other facilities have had to be expanded on account of frozen foods, but the data are not available for documenting these changes.

ZERO-DEGREE WAREHOUSING FACILITIES

The trend toward mass marketing of frozen foods is causing a shift in the location of long-term storage from terminal market and redistributing points to processing points. The causes of this shift are economic. As sales of frozen food have expanded, the buyer has been able to purchase in whole or mixed car and truck lots. By making those purchases directly from the packer at the production-point warehouse, he can eliminate at least half a month's storage charge, plus one handling charge at in-transit warehouses. Under this practice, the merchandise bypasses the in-transit warehouse by moving directly from the packer at the production-point warehouse to the distribution warehouse used by the frozen food distributor or retail buyer. Also, storing at the point of production minimizes any back-and-forth hauling and handling charges which might arise from the maldistribution of seasonally produced frozen food stored at distribution points.

The expanded sales of frozen food have not only increased the demand for storage facilities at processing points; they have also brought about a change in the type of storage facilities required at retail distribution points. The emphasis at retail distribution points now is on the rapid movement of stocks and not on long-term storage. Labor costs account for around one-half of distribution costs, according to accounting records of frozen food distributors. Therefore, there is considerable incentive for using facilities which minimize the amount of labor required and which expedite truck movement. These needs have not always been met by existing facilities. Many of the older warehouses are multistory units with elevator delays, and limited opportunities for mechanized handling; they may be ill adapted for increased truck volume, and located in areas of congested traffic. The statistics on zero-degree warehousing facilities do not reflect adequately the changes occurring in location and type of warehousing facilities. Facilities which store frozen foods for less than 30 days are not reported; neither are the improvements made in the older facilities reported. Nevertheless, the data do show a marked increase in zero-degree storage capacity as the frozen food industry developed.

Since 1940, frozen food production increased from 675 million to 9,007 million pounds in 1956 (12). 1/ Zero-degree warehouse capacity has increased from 86.6 million cubic feet in 1939 to 376.5 million in 1955, approximately 290 million cubic feet of space. In addition to the increased warehouse capacity there has been an increase in the rate of turnover of frozen foods in storage. Although the growth in warehousing capacity appears to have been adequate, the type and location of warehousing facilities may need further adjusting. Figure 1 shows the growth in production of frozen food. Table 1 shows the growth in zero-degree warehousing capacity and provides a breakdown by type of space.

1/ Underlined figures in parentheses refer to Literature Cited, p. 23.

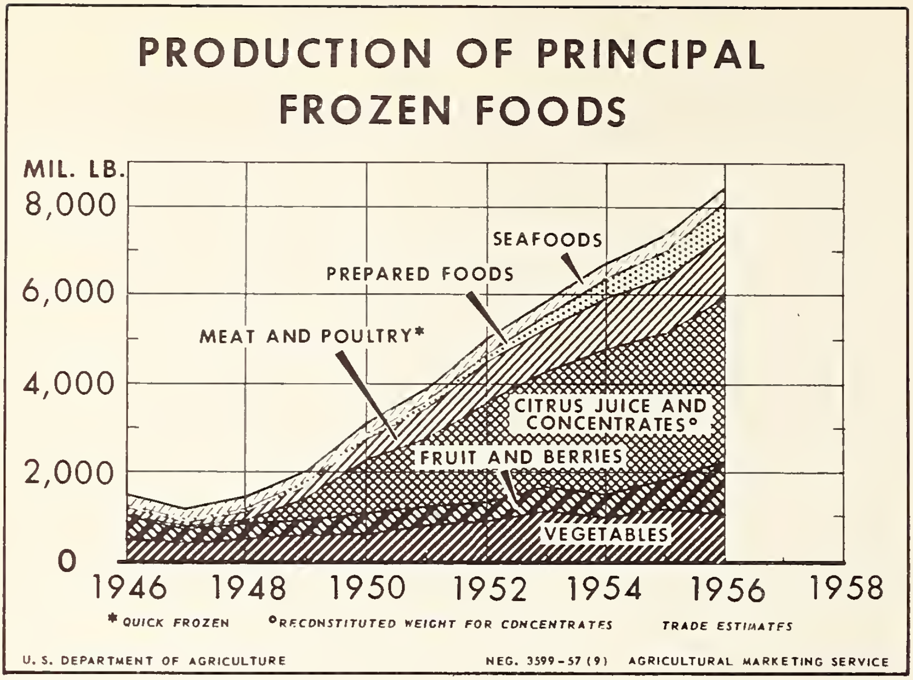

Figure 1

Table 1.--Refrigerated warehouse capacity at 0° F. or below, 1939-55

Date	Gross space, 0° F. or below			
	Public warehouses	Private and semi-private	Meat-packing	Total
	1,000 cu. ft.	1,000 cu. ft.	1,000 cu. ft.	1,000 cu. ft.
October 1:				
1939	65,804	8,246	12,538	86,588
1941 1/	84,379	8,427	15,110	107,916
1943	86,245	9,500	14,973	110,718
1945	110,448	11,944	12,492	134,884
1947	116,957	15,473	13,017	145,447
1949	134,296	21,397	12,257	167,950
1951	169,388	29,142	14,180	212,710
1953	2/ 257,868	2/ 60,218	2/ 29,242	2/ 347,328
1955	281,865	73,897	20,739	376,501

1/ June 16, 1941.
2/ 19° F. or below.

U. S. Dept. Agr., Agr. Mktg. Serv., Agr. Est. Div.

Figured at a construction cost of $1.50 per cubic foot of gross space, the total original investment in refrigerated warehouse capacity at zero degrees Fahrenheit or below through 1955 is about $565 million. This does not include warehousing space used for storing frozen foods for less than 30 days. The total investment is equivalent to an average increase of over $27 million each year since 1939. If this rate of investment continued through 1957 the total original investment would amount to approximately $620 million. Assuming a 20-percent depreciation allowance, total current investments in warehousing facilities would be around $500 million.

Frozen food distributors, retail store organizations, and warehousemen have been building distributor warehouses for frozen foods at retail distribution points. These facilities are designed for rapid movement of stocks, and storage usually is less than 30 days. This trend has been in response to the rapid growth of frozen food sales in areas where refrigerated warehouses did not exist or where they proved to be inadequate for efficient and rapid truck movement of frozen foods. As sales continue to increase it can be expected that additional warehousing space at retail distribution points will be needed for short-term storage. 2/

Production of frozen food has been growing at the rate of about 1 billion pounds per year since 1950. This rate would be exceeded in the future if the growth in frozen meats should materialize in line with trade estimates. According to some trade forecasts, sales of frozen meat will approach 20 percent of sales of fresh meat "within the next 5 years." This means that sales of frozen meat would amount to around 3 billion pounds, based upon present production levels.

Total production of frozen food for 1956 was almost 9 billion pounds (13). A yearly increase of 1 billion pounds would mean that frozen food production should double within 9 years, and that additional zero-degree storage facilities would be needed. The increase in production of frozen meats should not require additional storage space at both processing and distributing points. Because of the production pattern and the location of meatpacking plants in relation to consuming areas, the facilities at packing plants may serve both as long-time storage warehouses and as distributors' warehouses. A considerable part of the increase could represent a conversion of present refrigeration facilities to below-zero storage facilities.

The future growth of frozen foods and the accompanying needs for zero-degree storage facilities present a challenge to the warehouse industry to provide the type of service and facilities needed. The building of production warehouses by packers adds warehousing to food processing, thus calling for

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2/ The statistics on warehouse capacity at 0° F. and below will probably continue to show the growth occurring at processing points. For this reason one should not expect a direct relationship between growth of frozen food production and that of the reported total refrigerated warehouse capacity at 0° or below.

more capital. Packers already are confronted with a need for additional capital due to the larger inventories resulting from the short-term buying adopted in recent years by retail buyers. Commercial cold-storage facilities are now used by 70 percent of the frozen food processors in Washington, Oregon, and California for processing and initial storage, according to a recent study (16). A similar opportunity for the public warehouse industry exists at retail distribution points, where distribution warehouses could serve frozen food distributors and retail buyers. The emphasis here must be on minimizing the use of labor and on rapid distribution of stocks by trucks.

The ability to obtain investment capital, the efficiency in use of warehousing space, and the ability to provide the type of service demanded at competitive prices will play an important role in determining who will provide the zero-degree storage facilities of the future.

LOW-TEMPERATURE TRANSPORTATION FACILITIES

The growth of mechanically refrigerated cars and trailers has lagged behind the growth of frozen foods. Recently the numbers of mechanically refrigerated rail cars have been increasing rapidly, from a total of 3 in 1949 to over 2,500 at the present time. It is anticipated that all low-temperature cars for frozen foods eventually will be mechanically refrigerated. The use of salt and ice, even with properly insulated equipment, does not meet the low-temperature requirements of the frozen food industry. The pattern of growth in use of mechanically refrigerated cars is shown in table 2.

Table 2.--Mechanically refrigerated rail cars in service, 1948-58

Date	Cars in service (cumulative total)	Date	Cars in service (cumulative total)
January 1:		January 1:	
1948	3	1955	642
1949	3	1956	1,142
1950	6	1957	2,084
1951	29		
1952	169	January 31:	
1953	184	1958	2,571
1954	386	On order	1,171

Data from Association of American Railroads, Operation and Maintenance Department, Car Service Division.

Railroads now have a sizable investment in mechanical refrigerator cars. The refrigeration equipment for a car costs about $8,000, while the rail car itself runs between $15,000 and $18,000. If $25,000 per car is used as an average cost, the 2,571 cars in service would represent a $64 million investment, with over $29 million on order. It is difficult to estimate how fast and how far the trend toward mechanical refrigerator rail cars will go because mechanical refrigerator trailers also are expanding rapidly. Distances hauled, in-transit privileges, rate structure, and rapidity of service all enter into the decision between rail and truck service.

During the 10-year period 1948-57, over 39,000 insulated and refrigerator van-type truck trailers have been produced. The yearly production pattern is given in table 3.

Table 3.--Yearly production of insulated and refrigerated van-type truck trailers, 1948-57

Year	Number of trailers produced	Year	Number of trailers produced
1948	2,279	1954	4,290
1949	2,642	1955	5,229
1950	3,925	1956	5,367
1951	4,179	1957	4,550
1952	3,320		
1953	4,029	Total	39,810

Compiled by Truck-Trailer Manufacturers Association, Inc., from Bureau of Census "Facts for Industry" Reports.

According to trade estimates, approximately 39,000 refrigerator van-type truck trailers are now in service, representing an investment of over $390 million--or roughly $10,000 per trailer. The power units, or tractors, to haul the semitrailers represent an additional investment of $12,000 to $15,000 per unit. The total capital originally invested in complete hauling units would be over $800 million. This should probably be depreciated by 40 percent to arrive at current value, which would amount to around $500 million.

Since 1948 there has been a considerable change in the quality of the trailers produced, as well as an increase in the price. Current estimates on a 30-foot-deep, freeze-type truck trailer, with 6 inches of insulation, are around $14,000 to $15,000. A complete hauling unit (power unit and semitrailer) is probably double that of the semitrailer. It has been reported that some of the new complete hauling units run as high as $35,000.

Not all refrigerated trailers and trucks are used to transport frozen foods. It is not uncommon to haul frozen foods in one direction and haul other products on the return trip, or vice versa. The ownership pattern of refrigerated trailers and trucks indicates many users besides the frozen food industry. However, ownership data will not provide a reliable basis for estimating the extent of usage by the frozen food industry. A survey of ownership patterns in 1953 was made by the Aluminum Company of America, and is shown in table 4.

Table 4.--Estimated percentage distribution of refrigerated trailers and trucks, by ownership, 1953

Owner	Percentage of total refrigerated trailers owned	Owner	Percentage of total refrigerated trucks owned
Common and contract carriers	63	Meatpacking industry	30
Meatpacking industry	10	Ice cream industry	20
Frozen food industry	8	Dairy industry	17
Ice cream industry	8	Frozen food industry	13
Dairy industry	5	Common and contract carriers	13
Truck leasing companies	4	Truck leasing companies	4
Produce, florists, and other industries	2	Produce, florists, and other industries	3
Total	100	Total	100

Data from Commercial Research Division, Aluminum Company of America. Refrigeration in Trucks and Trailers.

It would appear that transportation facilities used for frozen foods will need to double in the next 7 or 8 years if frozen meat sales materialize in line with trade estimates. All new trailers and rail cars used for carrying frozen foods should maintain temperatures at zero or below to meet the requirements of the frozen food industry.

In addition to the insulated and refrigerated van-type trailers and mechanically refrigerated rail cars used to transport frozen foods from processing points to retail distribution points, there is a need for more smaller-type refrigerated trucks to distribute frozen foods from warehouses at retail distribution points to low-temperature storage and display cases in retail stores. These are the trucks used by frozen food distributors. Many of these trucks use the eutectic cold plate type of refrigeration for the short runs to retail stores and institutional outlets. A recent study of refrigeration in trucks and trailers by the Aluminum Company of America estimated that 195,000 refrigerated vehicles were in operation as of January 1, 1955. Table 5 shows the breakdown by size of truck and type of refrigeration.

Table 5.--Estimated distribution of refrigerated truck and trailer population, by type of refrigeration system used, 1956

Size of vehicle	Number of trucks, by type of refrigeration				
	Cold plate	Mechanical	Wet ice	Dry ice	Total
Light trucks (under 1½ tons)........	30,180	1,950	1,176	5,879	39,195
Medium trucks (1½ to 2½ tons)........	66,950	16,480	7,210	12,360	103,000
Heavy trucks (over 2½ tons).........	7,056	10,584	2,588	3,293	23,520
Trailers (vans)..........	1,764	25,478	588	1,470	29,400

Data from Commercial Research Division, Aluminum Company of America. Refrigeration in Trucks and Trailers.

LOW-TEMPERATURE DISPLAY CASES IN RETAIL STORES

Zero-degree cabinet space in retail stores has been and will continue to be a limiting factor to the growth of the frozen food industry. In one sense this is no different from the problem facing other commodities sold through retail outlets. Frozen foods must compete for space with other food and non-food items. There is not room in retail stores to display all the items seeking shelf space. Some of the new frozen food products must either (1) take space away from products now occupying the display area, (2) wait until some of the older stores are remodeled to provide additional display space, or (3) be limited to the new stores which provide additional space.

There are at least two reasons why the shortage of display space has been unusually severe on frozen foods. First of all, it is expensive to supply additional zero-degree cabinet space for frozen foods. Second, frozen foods represent many recent newcomers. It is the policy of some stores to limit the products handled to those having consumer acceptance and fairly rapid turnover. Until a new product has been made available to the consuming public it cannot meet such specifications. No doubt this restricts the growth of small firms as well as that of new products entering the market.

Limited zero-degree cabinet space in retail stores is more of a restriction on brands than on individual frozen foods. There may be a dozen or more brands for foods, such as frozen peas or orange juice concentrate, but only 2 or 3 brands will be displayed in a single store. The increase in sales volume resulting from adding more brands of the same frozen food may not justify the use of additional cabinet space. Today's battle of brands for limited cabinet space may encourage further mergers at the packing level.

The effect which frozen foods have had upon capital requirements at the retail level may be illustrated by the growth in zero-degree cabinets. A survey (see table 6) made by the National Association of Food Chains showed that their member stores averaged 23 lineal feet as of January 1950 and 33 lineal feet by January 1954 (10). The members were asked also to report the cabinet space which they considered adequate to meet the needs of their present stores. From 1950 to 1954 the average lineal feet of cabinet space in the stores had increased by almost 50 percent. Even with this increase, the amount of cabinet space considered to be adequate in 1954 (60 lineal feet) was almost double the actual cabinet space the stores reported at that time (33 lineal feet).

Table 6.--Frozen food cabinet space, in lineal feet, 1950 and 1954

Item	Reported		Considered adequate	
	1950	1954	1950	1954
	Feet	Feet	Feet	Feet
Average	23	33	36	60
Median	24	30	31	60
Range	10-42	10-90	18-95	14-120

The data in table 6 are for members of the National Association of Food Chains. Similar data are not available for independent stores. Surveys have been made at one time or another by varying trade papers on the total number of units in service in all types of retail food stores. It has been estimated that around 350,000 units are now in service. Since no average lineal footage or cubic footage figures are available, the numbers of units in service may not present a meaningful picture. This is particularly true because of the trend toward so-called island-type units, which provide more usable space than other units with the same lineal footage. Production of multideck cases also appears to be growing. The growth in zero-degree cabinet space has paralleled the growth in retail sales of frozen food because every pound of such frozen foods has been placed in a refrigerated case. Obviously, the growth in low-temperature display space in retail stores must continue if the growth in retail sales is to continue.

The capital investment in low-temperature cabinet space in retail stores is probably more than a third of a billion dollars, assuming the cost per cabinet, plus installation, would average around $1,000 each for the 350,000 units. This does not include backroom freezer storage space in retail stores. Chain Store Age reported that $3,550 was needed in 1953 for backroom storage of frozen foods (5). Progressive Grocer reported 27,100 chain and independent supermarkets in 1956 (15). If each of these stores provided backroom storage for frozen foods, the capital investment would amount to over $96 million. Not all supermarket stores provide backroom storage for frozen foods, although the trend is in this direction. The combined investment in display cabinets and backroom storage for frozen foods by 1958 probably would be over $400 million. If frozen food production should continue to grow at the rate of 1 billion pounds per year, it would call for heavy additional investments in both retail freezer storage and display cabinet space within the next decade.

FROZEN FOOD LOCKER PLANTS

Freezer capacity in frozen food locker plants complements freezer capacity in the home. However, the growth in frozen food locker plants preceded the growth in home freezers. The rapid expansion in sales of home freezers began about 1950. Since 1950 the number of locker plants has declined. A survey of frozen food locker plants made by the Farmer Cooperative Service indicates that the number of locker plants declined from a high of 11,600 plants in 1951 to 10,553 by January 1, 1955 (21). The number of locker plants has continued to decrease, falling to 10,344 in 1956 and to 9,894 in 1957.

The average-size locker plant probably has a net zero-degree storage capacity of around 3,000 cubic feet. This means that currently there are around 30 million cubic feet of net zero-degree storage capacity available for storing frozen foods. In addition, there are around 5 million cubic feet of freezer capacity. It has been estimated that this represents a current investment of around $500 million. It would appear that a further increase in zero-degree storage capacity in food locker plants is not essential to the future growth of commercial frozen foods.

CAPACITY OF HOME FREEZERS

In less than a decade the capacity of home freezers increased more than 5 times. Today the freezer capacity in America's kitchen is equivalent to 44 percent of the total zero-degree storage in refrigerated warehouses. There were over 9 million home freezer units in operation at the beginning of 1957, according to estimates made from the National Electrical Manufacturing Association's reported sales (11). The capacity of these units was estimated at 120.5 million cubic feet with a holding capacity of 3.6 billion pounds. This is equivalent to around 2.5 cubic feet for every family in the United States, exclusive of freezer storage in the modern refrigerators. [3] This represents a total original investment of around $2.4 billion in home freezers, if figured at $20 per cubic foot. Probably the original investment should be depreciated by 25 percent for current value, which would leave a total value of $1.8 billion in home freezers.

The relationship between the growth in total production of frozen food and the growth in zero-degree storage capacity in home freezers is shown in figure 2. The ratio of commercial frozen food production to home freezer capacity is shown in table 7. Currently, 1 pound of frozen foods can be stored in the home for every 2.5 pounds produced commercially each year. This rapid growth of zero-degree storage capacity in the home has aided the growth of the frozen food industry.

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[3] U. S. Bureau of the Census lists 42,843,000 total families as of March 1956 (20).

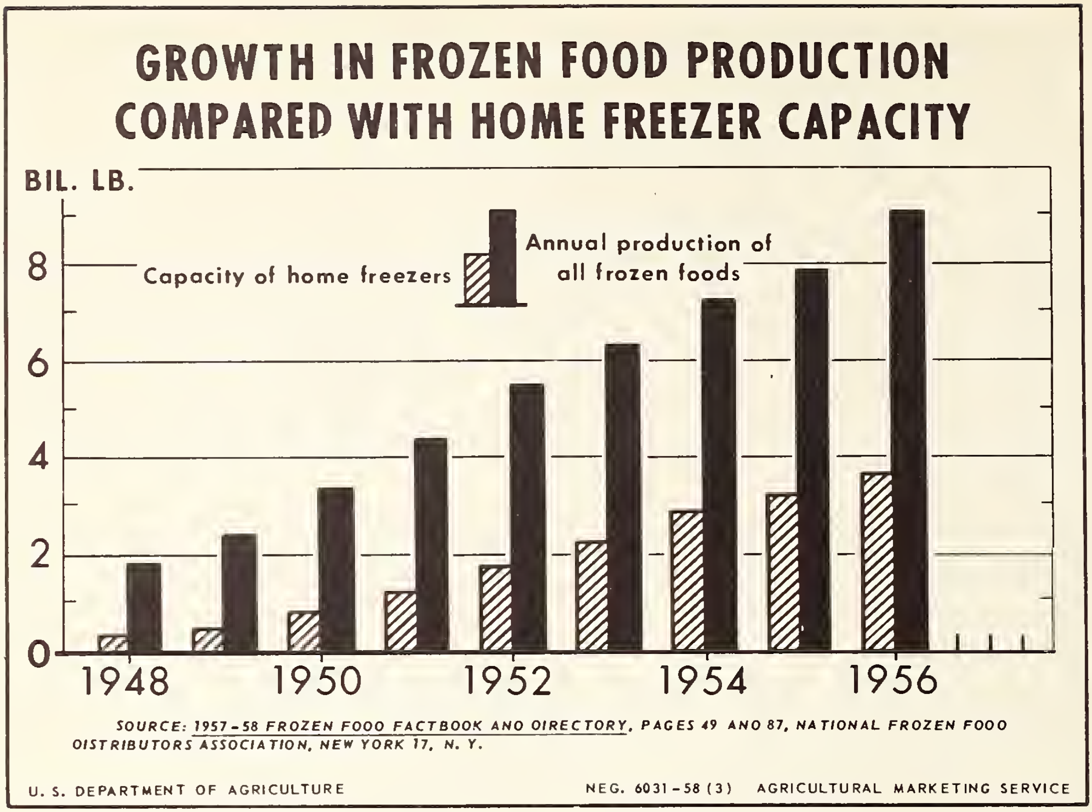

Figure 2

Table 7.--Pounds of commercial frozen food produced per pound of home freezer capacity, 1948-56

Year	Pounds	Year	Pounds
1948	5.45	1954	2.53
1950	3.93	1955	2.45
1952	3.10	1956	2.49
1953	2.78		

What is the relationship between the growth of frozen foods and the sales of home freezers? Since 1950, sales of home freezers have been at the rate of around 1 million units per year, while commercial production of frozen food has been at the average rate of about 1 billion pounds per year. Is this rate of home freezer sales essential to the continued growth in sales of frozen food?

According to an earlier study, families owning refrigerators with frozen food compartments bought as much frozen fruits and vegetables as families owning home freezers (3). However, families with ordinary refrigerators without frozen food compartments bought less frozen foods. Today around 93 percent of all families own refrigerators. The census data do not provide a separation between refrigerators with frozen food compartments and those without these compartments.

What effect do shopping habits have upon the need for refrigeration facilities? If housewives shop frequently do they need home freezers to store frozen foods? If merchandising practices provide no incentive for consumers to purchase more than 2 packages at a time, what effect does this have upon the sales of home freezers? Would larger single purchases of frozen foods increase total sales of frozen food? How do families use the home freezer space they now have? These are some of the questions which need answering before projecting the home refrigeration facilities essential to the estimated growth in sales of frozen food.

If home freezer sales were to continue at roughly 1 million units per year (1950-56), and if the 1954 average of 15.4 cubic foot per freezer is typical of future sales, then an annual investment of around $300 million probably would be required--assuming a cost of around $20 per cubic foot. Actually, the trend since 1949 has been toward larger-size home units.

A projection of home freezer sales at 1 million units per year corresponds to the estimated rate of family formation (table 8). What proportion of the new families can be expected to purchase home freezers or refrigerators with frozen food compartments? What will be the replacement market for home freezers now in use?

The history of frozen food growth since World War II has been one of acceleration. Should the growth of frozen meats materialize as some trade predictions indicate, home freezer sales may need to increase beyond 1 million units per year to keep pace with frozen food sales (9).

Table 8.--Number of households, for the United States, 1947 to 1956, and projections 1960 to 1975

Date	Census or survey figures	Projections 1/			
		Series I	Series II	Series III	Series IV
April 1947	39,107				
April 1948	40,532				
April 1949	42,182				
March 1950	43,554				
April 1951	44,656				
April 1952	45,504				
April 1953	46,334				
April 1954	46,893				
April 1955	47,788				
March 1956	48,785				
July 1960		51,838	51,573	51,060	50,499
July 1965		56,145	55,579	54,474	53,345
July 1970		61,378	60,762	58,988	57,110
July 1975		67,378	66,480	64,312	61,584

1/ According to the Series I projections, the number of households rises to 67.4 million in July 1975, representing an increase of almost 20 million over the estimated 47.8 million for 1955. Series IV shows a level of 61.6 million households in 1975, representing an increase of about 14 million during the 20 years. Series II and III indicate levels intermediate between those shown by Series I and IV. The four series of household projections imply an increase of 30 to 40 percent for the 20-year period.

U. S. Bureau of the Census. Current Population Reports, Series P-20, No. 69, August 31, 1956.

FROZEN FOOD DISTRIBUTORS

Frozen food distributors were born with the advent of the frozen food industry. They represent an essential link in the chain between the distribution warehouse and the retail store and institutional outlets. They have performed an educational and a promotional role in the development of the industry, as well as their primary function of distributing frozen foods under refrigerated conditions. The capital investment of frozen food distributors represents a net addition to the capital requirements of the frozen food industry. The distributor services three distinct types of customers: (1) The supermarket type of retail stores, including both chains and independents, (2) the smaller independent retail stores, and (3) the institutional outlets. Frozen food distributors may serve any one or all three of these outlets. 4/

Each type of outlet demands a different amount and kind of services. This affects both the distributors' operating costs and their capital requirements. Distributors must have adequate working capital to purchase and maintain an inventory on all the different kinds of frozen foods handled by their customers. Also, they increase their capital requirements by extending short-term credit through lengthening collection periods. In addition, distributors must have the usual amount of working capital necessary to handle the operating expenses for a business of a given size. Labor expenses represent one-half or more of the operating costs. Distributors may either own, rent, or lease warehousing facilities. They own the refrigerated trucks for delivering frozen foods from warehouses to the retail or institutional customers. All of these factors contribute to the capital requirements of a frozen food distributor.

Wholesale grocers, produce distributors, or chainstore warehouse operators may take on the function of distributing frozen foods in addition to their other operations. This requires the same type of refrigeration facilities, services, and capital investments as those provided by the frozen food distributors.

The 1954 census reported 610 frozen food distributors (18), with total sales amounting to $455,882,000. According to uniform accounting records (4)

4/ As the frozen food industry has grown, chain stores which purchase directly from food packers have been distributing increasing quantities from chain distribution warehouses. Under this procedure the frozen food distributor is bypassed. The distributor's order assembly operation is handled by the warehouse; a trucking organization may provide the delivery service; the member stores take over the job of stocking the frozen food cabinets, price marking the merchandise and arranging the displays. In other cases where the retail buying organization does not use its own distribution warehouse, a frozen food distributor may provide (1) the order assembly operation or (2) the drayage (delivery) service, or (3) both of these. There appears to be no fixed pattern in the industry.

from 17 firms, the ratio of net sales to tangible net worth averaged 1.46 for 1956. Applying this ratio to the sales of the 610 firms in 1954 gives a tangible net worth of $312,247,945 for the industry. From 1954 to 1957, retail sales of frozen foods increased by 32 percent, or 16 percent per year for 1955 and 1956 (14). Assuming a similar increase for 1957 and assuming that the increase in distributors' sales corresponded to that of retail sales would give a total of $674,705,000 for distributors' sales in 1957. Applying the ratio of $1.46 of sales to each dollar of tangible net worth gives a current investment of around $462 million for the frozen food distributors.

Will the number of frozen food distributors increase as frozen foods grow in volume? The frozen food distributors are sandwiched in between processors on the one hand and retailers and institutional outlets on the other. The overall operations of both the processors and retail buying organizations are much larger than those of the distributors. The increase of retailers' labels, coupled with the increase in direct buying of packers' nationally advertised brands by the large retail purchasing units, has placed distributors in a vulnerable position. Distributors have attempted to adjust to the needs of large-volume, low-margin distribution by (1) attaining economies of scale, and (2) improving the quality of their services and efficiency in performing them. The sales volume of most distributors falls between $500,000 and $5 million. Based on uniform accounting records, a distributor can achieve sufficient economies of scale at annual sales of around $1 million to be competitive with the large-scale operators. This can be demonstrated by the fact that the average size of orders and the man-hours required per $100 of sales can be about the same for relatively small operators as for those with large-scale operations. Nevertheless, it would appear that the continuing growth of the frozen food industry will be absorbed by distributors already in the business rather than by new distributors entering. The trend toward larger operations is being accentuated to some extent through mergers and through the disappearance of some small firms. Increasing capital requirements and shortage of efficient management are contributing factors.

Competition is such that the chainstores and independent supermarkets stand ready either to shift their buying from one distributor to another or to take over the functions of the frozen food distributors if they suspect that this might lower distribution costs. The future role of frozen food distributors depends upon their ability to provide flexibility in the services offered to different types of customers and to perform these services efficiently at competitive prices. Distributors are likely to become larger or more specialized, or both.

FROZEN FOOD PROCESSORS

Two major factors contribute to the capital requirements of frozen food processors: (1) The size of plant essential to attaining the efficiencies of large-scale operations, and (2) the volume, quality, and delivery terms specified by the large retail buyers. A recent report on frozen potato products stated that, to produce frozen potato products competitively, a new manufacturer would need $1½ million (1). This amount included the cost of equipment necessary for freezing and storing at the plant. An additional $1 million would be required for working capital to produce and carry the product, according to this article.

With the development of mass marketing of frozen foods, retail buyers take delivery of frozen foods as they need them rather than at the time the foods are processed. This means that the frozen fruit and vegetable packers must store around one-half of their annual production during most of the year.

The 1954 census reports 266 frozen fruit and vegetable packers with shipments valued at $417,140,000 (19). If shipments valued at one-half of this amount are carried in inventory, then roughly $208,570,000 of working capital would be required for producing and carrying frozen fruits and vegetables. (Obviously this amount will vary during the year for seasonal products.) If the ratio of $1½ million for plant and facilities to $1 million for producing and carrying the product holds for the entire industry, then the 266 firms would have $312,855,000 invested in plant and facilities. Undoubtedly, most of these plants are at least 10 years old. A 25-percent depreciation of plant and equipment would leave a total plant investment of around $240 million for frozen fruit and vegetable processors. According to this method, total capital investment would amount to around $450 million when working capital requirements are included.

Dun and Bradstreet reports show a 5-year (1951-56) average ratio of $5.05 of net sales to $1 of net working capital for fruit and vegetable canners (6). If this ratio were representative of frozen fruit and vegetable packers, only $82,602,000 of working capital would be required for the $417,140,000 of shipments reported by the 1954 census. Assuming a ratio of 1½ to 1 between plant and facilities and working capital would give $123,903,000 in plant and facilities and a total capital investment of $206,505,000. Probably total capital investment for frozen fruit and vegetable packers is somewhere between the $206 million based on the Dun and Bradstreet reports for canners and the $450 million based on inventories of one-half the annual shipments of frozen food packers. An estimate of $300 million for 1954 would appear reasonable for frozen food packers, since their capital requirements for refrigeration equipment and inventories would be higher than those of the fruit and vegetable canners. Based upon growth in pounds produced, frozen vegetables, fruits, and juices have increased around 10 percent per year since 1954. A corresponding increase in capital investment would mean a current investment of around $390 million.

The annual survey of frozen food sales made by Food Field Reporter and Food Topics shows total frozen food sales of $1,981 million for 1956 (14). Frozen vegetables, fruits, and juices account for 38.7 percent of the total sales. Estimating the capital requirements for frozen vegetables, fruits, and juices to be $390 million and assuming a similar relationship between sales and capital investment for frozen meats, poultry, seafood, and prepared foods, then the total capital investment for all frozen food plants would be around $1 billion.

As the growth in frozen food continues, additional capital will be required by processors. The rapid growth of the frozen food industry has not represented a continuing expansion of all frozen food items (2, 17). Rather, it has represented an increase in new frozen foods whose rate of production increased rapidly and then tended to level off in normal growth-curve fashion. This does not mean that further expansion of items now sold in large volume will end. It means that the greater part of future capital requirements will come from more recently introduced items, such as frozen prepared foods and meats.

In addition to the growth in capital requirements resulting from the expansion of production, the frozen food processors have had to finance larger inventories because of the direct short-term buying practices of the large retail buying units. There is little reason to believe that this trend will be reversed in the future. For the same reasons that led to the recent shift in location of frozen food storage, the overall marketing costs are reduced even though the capital requirements of the frozen food packers are increased.

In response to this situation, one of the large packers of frozen orange juice concentrate recently took the initiative in organizing a growers' cooperative to serve as his supply unit. The fruit furnished by the cooperative will be processed for the cooperative's account and all proceeds above the cost of processing and marketing will be returned to the growers, less a small percentage of the net for the processor. In effect, the processor has freed his working capital that was tied up in inventories. The growers' cooperative now holds the inventory. The packer also has hedged against price fluctuation by this arrangement. To what extent will this new development set a pattern for industry?

IMPLICATIONS TO GROWERS

The growth in mass merchandising of frozen foods has increased the demand for large volumes with uniform quality. The ideal food product to meet these needs from a retailer's and consumer's standpoint is one that has the same quality in January as it does in July; that has the same quality in Spokane, Wash. as it does in Miami, Fla. This is a difficult assignment. It requires additional capital investments. In order to approach such uniform quality, processors may seek more control over the production and harvesting practices of growers. If growers fail to meet the rigid specifications essential to uniform quality, food processors may attempt to protect themselves by further contractual arrangements with growers or by entering into direct production of the commodities they are using. If processors fail to insure uniformity in quality of their products, the large retail buying units may attempt to take over these functions themselves, either through contractual arrangements or through ownership of the facilities. The latter means integration of retail ownership back through the production level. The economic advantages which mass merchandising appears to offer the overall marketing system tend to encourage the retail buying units to control the quality of their supplies. What effect will increases in contract farming and in integration have upon availability of markets and returns to growers?

Mass merchandising of frozen foods tends to increase the scale of production and to increase specialization by growers. In turn, this increases the capital requirements of the growers. Where growers are unable to obtain the needed capital, processors may be called upon to supply seed, fertilizers, and equipment to the growers. Food processors may even go so far as to take over the planting and harvesting operations, with farmers supplying only the land plus their own labor. When this occurs, all the managerial decisions are shifted from the grower to the food processor. Recent studies on grower-processor relations document these trends (7, 8). [5]

The trend toward mass merchandising may also affect the competitive position of different producing areas. Certain producing areas may have advantages over other areas in supplying large volumes of food products with relatively uniform qualities as required by mass merchandising. A study of interregional competition for selected frozen fruits and vegetables has been undertaken at the University of California, the State College of Washington, Oregon State College, and the University of Hawaii. Information to be obtained in the study should help producers in this region adjust to the requirements of mass distribution of their products. What economic alternatives are available to growers in other producing areas in adjusting to requirements of mass distribution? The relative advantages and disadvantages of these alternatives should be thoroughly examined. The United States Department of Agriculture is conducting research on this broad question.

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[5] Stutts, H. P. Unpublished data.

CONCLUSIONS

Frozen foods represent a $\$5\frac{1}{4}$ billion investment. Most of this has been made in the last 10 years. The investment components are estimated as follows:

Item	Amount
	Million dollars
Zero-degree warehousing facilities	$500
Mechanically refrigerated railroad cars	93
Refrigerated van-type truck trailers	500
Retail store cabinets and backroom storage	400
Home freezers	1,800
Frozen food lockers	500
Frozen food distribution	462
Frozen food processing	1,000
Total	5,255

The increase in the amount of capital invested in the frozen food industry is a measure of significant changes in the facilities for food distribution and in the marketing structure. The growth of capital requirements is associated with increases in mass production and mass distribution. The rapid expansion of supermarket-type stores with their increased capital requirements typifies the trend toward greater size of operations and greater specialization. The type of storage facilities and the location where specific marketing services are performed are also changing. As capital requirements continue to increase, further consideration needs to be given to the effect upon freedom of entry into the frozen food industry; the effect of access to capital on freedom of entry; and the types of promotional media needed to expand markets.

The present indications are that ability to obtain capital and to use it efficiently will become more of a limiting factor upon freedom of entry into the frozen food business. The pressure of competition would indicate that it will become increasingly difficult for operations of inefficient size to gain a foothold. Increased specialization may enable small operators, especially distributors, to compete successfully with the larger firms.

The trend toward large-volume, low-margin distribution of frozen foods may become increasingly restrictive upon the introduction and promotion of new products. This could become more of a limiting factor upon the growth of the frozen food industry than the ability to obtain capital. In the past the rapid growth of the frozen food industry has been due largely to the introduction of new frozen products.

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